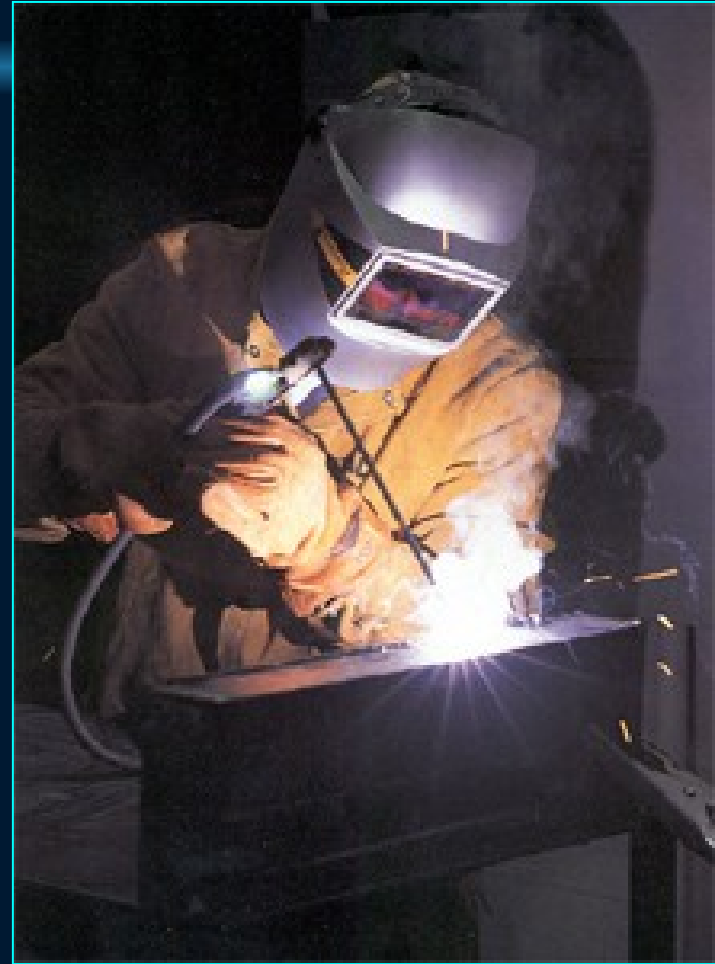


Welding

1910 Subpart





Subpart Q

- ☼ 1910.251 - Definitions
- ▮ 1910.252 - General Requirements
- ▮ 1910.253 - Oxygen-fuel gas welding and cutting
- ▮ 1910.254 - Arc welding and cutting
- ▮ 1910.255 - Resistance welding




Incorporated by reference as specified in Sec. 1910.6

⚙ Various ANSI Standards

- American National Standards Institute (ANSI), 11 West 42nd St., New York, NY 10036:

▮ Various Compressed Gas Association Standards

- Compressed Gas Association (CGA), 1235 Jefferson Davis Highway, Arlington, VA 22202



Incorporated by reference as specified in Sec. 1910.6

- ⦿ **The following material is available for purchase from the American Welding Society (AWS), 550 NW, LeJeune Road, P.O. Box 351040, Miami FL 33135:**
 - ▮ AWS A3.0 (1969) Terms and Definitions, IBR approved for §1910.251(c).
 - ▮ AWS A6.1 (1966) Recommended Safe Practices for Gas Shielded Arc Welding, IBR approved for §1910.254(d)(1).
 - ▮ AWS B3.0-41 Standard Qualification Procedure, IBR approved for §1910.67(c)(5)(i).



Incorporated by reference as specified in Sec. 1910.6

- ⦿ AWS D1.0-1966 Code for Welding in Building Construction, IBR approved for §1910.27(b)(6).
- ▮ AWS D2.0-69 Specifications for Welding Highway and Railway Bridges, IBR approved for §1910.67(c)(5)(iv).
- ▮ AWS D8.4-61 Recommended Practices for Automotive Welding Design, IBR approved for §1910.67(c)(5)(ii).
- ▮ AWS D10.9-69 Standard Qualification of Welding Procedures and Welders for Piping and Tubing, IBR approved for §1910.67(c)(5)(iii).



Other Related OSHA Standards

- ⚙ 1910.102 - Acetylene
- ▮ 1910.104 - Oxygen
- ▮ 1926.350 - Gas welding and cutting
- ▮ 1926.351 - Arc welding and cutting
- ▮ 1926.352 - Fire prevention
- ▮ 1926.353 - Ventilation and protection in welding, cutting, and heating
- ▮ 1926.354 - Welding, cutting, and heating in way of preservative coatings



NFPA Standards

- ▮ NFPA 10 - Portable Fire Extinguishers
- ▮ NFPA 50 - Bulk Oxygen Systems at Consumer Sites
- ▮ NFPA 51 - Oxygen- Fuel Gas Systems for Welding
- ▮ NFPA 51A - Acetylene Cylinder Charging Plants
- ▮ NFPA 51B - Fire Prevention for Cutting and Welding
- ▮ NFPA 70 - National Electric Code
- ▮ NFPA 306 - Control of Gas Hazards on Vessels
- ▮ NFPA 327 - Cleaning or Safeguarding of Small Tanks and Containers



Definitions

- ⦿ "Welder" and "welding operator" mean any operator of electric or gas welding and cutting equipment.
- ▮ "Approved" means listed or approved by a nationally recognized testing laboratory.



Definitions

- ▮ All other welding terms are used in accordance with American Welding Society - Terms and Definitions - A3.0-1969, which is incorporated by reference as specified in Sec. 1910.6

General Requirements

Fire Prevention and Protection

Basic Precautions

☼ Fire hazards

- If the object to be welded or cut cannot readily be moved, all movable fire hazards in the vicinity shall be taken to a safe place

▮ Guards

- If the object to be welded or cut cannot be moved and if all the fire hazards cannot be removed, then guards shall be used to confine the heat, sparks, and slag, and to protect the immovable fire hazards.



General Requirements

Fire Prevention and Protection

Basic Precautions

▮ Restrictions

- If the requirements stated in fire hazards and guards sections cannot be followed then welding and cutting shall not be performed.

General Requirements

Fire Prevention and Protection

Special Precautions

- ▮ Suitable fire extinguishers shall be maintained in a state of readiness
- ▮ Fire Watchers are required whenever welding and cutting is performed in locations where other than a minor fire might develop





General Requirements

Fire Prevention and Protection

Special Precautions

- **Fire Watchers are also required when:**
 - Appreciable combustible materials, in building construction or contents, are closer than 35 feet to the point of operation
 - Appreciable combustible materials more than 35 feet away but are easily ignited by sparks
 - A fire watch shall be maintained for at least one half hour after the completion of welding or cutting operations



General Requirements

Fire Prevention and Protection

Special Precautions

- ☼ Cutting or welding shall not be permitted in the following situations:
 - In areas not authorized by management
 - In sprinkled buildings when protection is impaired
 - In the presence of explosive atmospheres



General Requirements

Fire Prevention and Protection

- ⚙️ Welding or cutting containers
 - Will be cleaned so thoroughly as to make absolutely certain that there are no flammable materials present or any substances such as greases, tars, acids, or other materials which when subjected to heat, might produce flammable or toxic vapors.
- ▮ Any pipe lines or connections to the drum or vessel shall be disconnected or blanked



General Requirements

Fire Prevention and Protection

☼ Confined spaces.

- When arc welding is to be suspended for any substantial period of time, such as during lunch or overnight, all electrodes shall be removed from the holders and the holders carefully located so that accidental contact cannot occur and the machine be disconnected from the power source



General Requirements

Fire Prevention and Protection

▮ Confined spaces

- In order to eliminate the possibility of gas escaping through leaks or improperly closed valves, when gas welding or cutting, the torch valves shall be closed and the gas supply to the torch positively shut off at some point outside the confined area whenever the torch is not to be used for a substantial period of time, such as during lunch hour or overnight
- Where practicable, the torch and hose shall also be removed from the confined space



General Requirements

Protection of Personnel

⚙ General

- Railing
 - A welder or helper working on platforms, scaffolds, or runways shall be protected against falling. This may be accomplished by the use of railings, safety belts, life lines, or some other equally effective safeguards.
- Welding cable
 - Welders shall place welding cable and other equipment so that it is clear of passageways, ladders, and stairways.

Personnel Protection





General Requirements

Protection of Personnel

☼ Eye protection

- Helmets or hand shields shall be used during all arc welding or arc cutting operations, excluding submerged arc welding. Helpers or attendants shall be provided with proper eye protection.
- Goggles or other suitable eye protection shall be used during all gas welding or oxygen cutting operations. Spectacles without side shields, with suitable filter lenses are permitted for use during gas welding operations on light work, for torch brazing or for inspection.



General Requirements

Protection of Personnel

Welding Operation |
Shade No.

Shielded metal-arc welding -

1/16-, 3/32-, 1/8-, 5/32-inch electrodes
10

Gas-shielded arc welding (nonferrous) -

1/16-, 3/32-, 1/8-, 5/32-inch electrodes
11

Gas-shielded arc welding (ferrous) -

1/16-, 3/32-, 1/8-, 5/32-inch electrodes
12

Soldering

General Requirements Protection of Personnel

☼ Airline respirators

- In circumstances for which it is impossible to provide such ventilation

▮ SCBA

- In IDLH Atmospheres





General Requirements

Confined Spaces

- ▮ Confined space means a relatively small or restricted space such as a tank, boiler, pressure vessel, or small compartment of a ship
- ▮ Ventilation is a prerequisite to work in confined spaces



General Requirements

Confined Spaces

- ▮ Securing cylinders and machinery
 - When welding or cutting is being performed in any confined spaces the gas cylinders and welding machines shall be left on the outside.



General Requirements

Confined Spaces

⚙ Lifelines

- Where a welder must enter a confined space through a manhole or other small opening, means shall be provided for quickly removing him in case of emergency.
- An attendant with a pre-planned rescue procedure shall be stationed outside to observe the welder at all times and be capable of putting rescue operations into effect.



General Requirements


Confined Spaces

- ⚙ All welding and cutting operations carried on in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency.
- ▢ This applies not only to the welder but also to helpers and other personnel in the immediate vicinity. All air replacing that withdrawn shall be clean and respirable.




General Requirements Health Protection and Ventilation

- ⚙ Mechanical ventilation is required when welding or cutting is done with materials in this section
- ▮ Materials such as fluorine compounds, zinc, lead, beryllium, cadmium, mercury, cleaning compounds and stainless steel are particularly hazardous and specific control requirements




Oxygen fuel gas welding and cutting 1910.253

- ☼ Flammable mixture
 - ▮ Mixtures of fuel gases and air or oxygen may be explosive and shall be guarded against.
 - ▮ Cutting torch temperatures exceed 5000 degrees F



Oxygen-fuel gas welding and cutting 1910.253

- ▮ Maximum pressure
- ▮ Under no condition shall acetylene be generated, piped or utilized at a pressure in excess of 15 psig (103 kPa gauge pressure) or 30 psia (206 kPa absolute)




Oxygen-fuel gas welding and cutting 1910.253

- ▮ Apparatus
- ▮ Only approved apparatus such as torches, regulators or pressure-reducing valves, acetylene generators, and manifolds shall be used.

Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Cylinders and containers
- ⚙ All portable cylinders used for the storage and shipment of compressed gases shall be constructed and maintained in accordance with the regulations of the U.S. Department of Transportation, 49 CFR Parts 171-179.




Oxygen acetylene gas welding and cutting 1910.253

- ⚙ Design of Acetylene Cylinder
- ▢ Filled with Calcium Silicate

Oxygen-fuel gas welding and cutting 1910.253

- ▮ Cylinders and containers
 - ⚙ Compressed gas cylinders shall be legibly marked, for the purpose of identifying the gas content, with either the chemical or the trade name of the gas.
 - ▮ Such marking shall be by means of stenciling, stamping, or labeling, and shall not be readily removable. Whenever practical, the marking shall be located on the shoulder of the cylinder.



Oxygen-fuel gas welding and cutting 1910.253


- ▮ Storage of cylinders-general
- ▮ Cylinders shall be kept away from radiators and other sources of heat.
- ▮ Inside of buildings, cylinders shall be stored in a well-protected, well-ventilated, dry location, at least 20 (6.1 m) feet from highly combustible materials such as oil or excelsior. Cylinders should be stored in definitely assigned places away from elevators, stairs, or gangways.



Oxygen fuel gas welding and cutting 1910.253

⚙ Storage of cylinders-general

- ▮ Assigned storage spaces shall be located where cylinders will not be knocked over or damaged by passing or falling objects, or subject to tampering by unauthorized persons.
- ▮ Cylinders shall not be kept in unventilated enclosures such as lockers and cupboards.
- ▮ Empty cylinders shall have their valves closed.



Oxygen and acetylene gas welding and cutting 1910.253

- ▮ Oxygen and acetylene cylinders in storage must be separated by 20 feet
- ▮ Or a 1/2 hour fire wall (5ft.)



Oxygen-fuel gas welding and cutting 1910.253

- ▮ Valve protection caps, where cylinder is designed to accept a cap, shall always be in place, hand-tight, except when cylinders are in use or connected for use.



Oxygen-fuel gas welding and cutting 1910.253

- ▮ Fuel-gas cylinder storage.
- ▮ Inside a building, cylinders, except those in actual use or attached ready for use, shall be limited to a total gas capacity of 2,000 cubic feet (56 m³) or 300 pounds (135.9 kg) of liquefied petroleum gas.

Oxygen-fuel gas welding and cutting 1910.253

- ▮ Fuel-gas cylinder storage.
 - ⚙ For storage in excess of 2,000 cubic feet (56 m³) total gas capacity of cylinders or 300 pounds (135.9 kg) of liquefied petroleum gas, a separate room or compartment shall be provided, or cylinders shall be kept outside or in a special building.
- ▮ Special buildings, rooms or compartments shall have no open flame for heating or lighting and shall be well ventilated.




Oxygen fuel gas welding and cutting 1910.253

- ▮ Oxygen storage
- ▮ Oxygen cylinders shall not be stored near highly combustible material, especially oil and grease.

Oxygen fuel gas welding and cutting 1910.253

- ⚙ Operating procedures.
 - ▮ Cylinders, cylinder valves, couplings, regulators, hose, and apparatus shall be kept free from oily or greasy substances.
 - ▮ Oxygen cylinders or apparatus shall not be handled with oily hands or gloves.



Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Operating procedures
- ⚙ When transporting cylinders by a crane or derrick, a cradle, boat, or suitable platform shall be used.
 - Slings or electric magnets shall not be used for this purpose.
 - Valve-protection caps, where cylinder is designed to accept a cap, shall always be in place.

Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Valve-protection caps shall not be used for lifting cylinders from one vertical position to another.
 - Bars shall not be used under valves or valve-protection caps to pry cylinders loose when frozen to the ground or otherwise fixed; the use of warm (not boiling) water is recommended.
 - Valve-protection caps are designed to protect cylinder valves from damage.



Oxygen fuel gas welding and cutting 1910.253

- ⦿ Unless cylinders are secured on a special truck, regulators shall be removed and valve-protection caps, when provided for, shall be put in place before cylinders are moved.




Oxygen-fuel gas welding and cutting 1910.253

- ▮ Cylinders not having fixed hand wheels shall have keys, handles, or nonadjustable wrenches on valve stems while these cylinders are in service.
 - In multiple cylinder installations only one key or handle is required for each manifold.
- ▮ Cylinder valves shall be closed before moving cylinders.



Oxygen fuel gas welding and cutting 1910.253

- ▮ Cylinder valves shall be closed when work is finished.
- ▮ Valves of empty cylinders shall be closed.



Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Cylinders shall be kept far enough away from the actual welding or cutting operation so that sparks, hot slag, or flame will not reach them, or fire-resistant shields shall be provided.
- ▮ Cylinders shall not be placed where they might become part of an electric circuit.



Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Cylinders shall be kept away from radiators, piping systems, layout tables, etc., that may be used for grounding electric circuits such as for arc welding machines.
- ▮ Any practice such as the tapping of an electrode against a cylinder to strike an arc shall be prohibited.
- ▮ Cylinders shall never be used as rollers or supports, whether full or empty.



Oxygen acetylene gas welding and cutting 1910.253

- ▮ Before connecting the regulator to the cylinder valve, the valve shall be opened slightly for an instant and then closed. Always stand to one side of the outlet when opening the cylinder valve.

Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Protective equipment, hose, and regulators
 - ▮ Equipment shall be installed and used only in the service for which it is approved and as recommended by the manufacturer.

Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Piping protective equipment.
 - ▮ The fuel-gas and oxygen piping systems, including portable outlet headers shall incorporate the protective equipment
 - ▮ Backflow of oxygen into the fuel-gas supply system
 - ▮ Passage of a flash back into the fuel-gas supply system

Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Hose and hose connections.
- ⚙ Hose for oxy-fuel gas service shall comply with the Specification for Rubber Welding Hose, 1958, Compressed Gas Association and Rubber Manufacturers Association
 - ▮ When parallel lengths of oxygen and acetylene hose are taped together for convenience and to prevent tangling, not more than 4 inches (10.2 cm) out of 12 inches (30.5 cm) shall be covered by tape.

Oxygen-fuel gas welding and cutting 1910.253

▮ Hose and hose connections

- ⚙ Hose connections shall comply with the Standard Hose Connection Specifications, 1957, Compressed Gas Association.
- ⚙ Hose connections shall be clamped or otherwise securely fastened in a manner that will withstand, without leakage, twice the pressure to which they are normally subjected in service
- ▮ Hose showing leaks, burns, worn places, or other defects rendering it unfit for service shall be repaired or replaced.

Oxygen-fuel gas welding and cutting 1910.253

- ⚙ Pressure-reducing regulators.
- ⚙ Pressure-reducing regulators shall be used only for the gas and pressures for which they are intended.
- ▮ When regulators or parts of regulators, including gages, need repair, the work shall be performed by skilled mechanics who have been properly instructed.

Oxygen fuel gas welding and cutting 1910.253

- ⚙ Pressure-reducing regulators.
- ⚙ Gages on oxygen regulators shall be marked "USE NO OIL."
- ▮ Union nuts and connections on regulators shall be inspected before use to detect faulty seats which may cause leakage of gas when the regulators are attached to the cylinder valves.

Arc welding and cutting

1910.254

- ⦿ In the arc welding process, an electric current passing through the welding rod or electrode is forced to jump or arc across a gap. The resulting arc produces the intense heat necessary for the arc welding and cutting operation.



1910.254

- ⚙ Arc welding is used to fabricate nearly all types of carbon and alloy steels, the common nonferrous metals, and is indispensable in the repair and reclamation of metallic machine parts

Are welding and cutting

1910.254

- ▮ Equipment selection.
- ▮ Welding equipment shall be chosen for safe application to the work to be done
- ▮ Installation.
- ▮ Welding equipment shall be installed safely



Arc welding and cutting

1910.254

- ▮ Instruction.
- ▮ Workmen designated to operate arc welding equipment shall have been properly instructed and qualified to operate such equipment

1910.254

- ▮ On all types of arc welding machines, control apparatus shall be enclosed except for the operating wheels, levers, or handles.

1910.254

- ☼ Terminals for welding leads should be protected from accidental electrical contact by personnel or by metal objects i.e., vehicles, crane hooks, etc.

Arc Welding and Cutting

1910.254

- ⚙ Workmen assigned to operate or maintain arc welding equipment shall be acquainted with the requirements of this section and with 1910.252
- ▮ If doing gas-shielded arc welding, also Recommended Safe Practices for Gas-Shielded Arc Welding, A6.1-1966, American Welding Society

1910.254

▮ Electrode holders.

- Electrode holders when not in use shall be so placed that they cannot make electrical contact with persons, conducting objects, fuel or compressed gas tanks.

▮ Electric shock.

- Cables with splices within 10 feet (3 m) of the holder shall not be used. The welder should not coil or loop welding electrode cable around parts of his body.

Resistance Welding

1910.255

- ⚙ Installation
 - ▮ Thermal protection
 - ▮ Personnel
 - ▮ Guarding
 - ▮ Spot and seam welding machines
 - ▮ Voltage
 - ▮ Capacitor welding
- ▮ Interlocks
- ▮ Guarding
- ▮ Shields
- ▮ Foot switches
- ▮ Stop buttons
- ▮ Safety pins
- ▮ Grounding



Other Information

- ▮ American Welding Society
 - www.aws.org
- ⚙ National Welding Supply Association
 - www.welderssupply.com



Review

- ⚙ What is the maximum working pressure of acetylene in cutting operations?
- ▮ Is a fire watch required after welding operations? If so, how long?
- ▮ If lifting the the welding cart by a crane, do the regulators have to be removed?
- ▮ What precautions must be taken when welding in confined spaces?